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enough for this paper. This general remark, however, should be carefully weighed. The cañon of the Columbia, the Yosemite Valley, the Charquinez Strait connecting the Suisun and San Pablo Bays, and the Golden Gate itself, through which the waters of the Sacramento and the San Joaquin, draining the great Valley of California, find their way to the ocean, are all about a mile wide. With the exception of the cañon of the Mississippi, the same is true, it is here repeated, of all the cañons above referred to in the Rocky Mountains and east of them, noticed in this paper. It is submitted, therefore, that the main facts in regard to them, point almost unmistakably to a similar origin for them all. All these cañons I have myself visited, many of them several times. Several of them are splendid, even sublime, beyond the power of the most accomplished pen to describe. I dared not to attempt it, and have, therefore, simply stated what I have myself seen and drawn such conclusions as the facts seemed to warrant.

Let me add a very few words in conclusion upon a paper on the geological history of the Colorado River and the plateau of it, read at the St. Louis meeting by Col. E. C. Dutton, of Washington. This cañon, as described by Maj. Powell, who has the honor of braving almost incredible dangers to explore it and to give the world their first knowledge of its wonders, is some 1,500 miles long; the perpendicular walls are a mile or a fraction of it apart, and are from 1,000 to 5,000 feet high. They are composed of nearly all the series in the geological catalogue, from the granite all the way up to the highest igneous stratified rocks. Now this, by far the longest, and in some respects the most wonderful cañon in the world, Col. Dutton described as having been worn by the Colorado River. In view of the facts herein presented that conclusions seems supremely fanciful and absurd. Like all the others, it could only have been formed by some great convulsion of the earth's crust, and through it the drainage of nearly a thousand miles along the western slopes of the Rocky Mountains finds its way to the Gulf of California.

ADDRESS OF COL. GARRICK MALLERY, U. S. ARMY.

Chairman of the Subsection of Anthropology of the A. A. A. S. at the Opening of that Subsection.

THE GESTURE SPEECH OF MAN.

Anthropology tells the march of mankind out of savagery in which different people have advanced in varying degrees, but all started in progress to civilization from a point lower than that now occupied by the lowest of the tribes now found on earth. The marks of their rude origin, retained by all, are of the same number and kind, though differing in distinctness, showing a common origin to all intellectual and social development, notwithstanding present diversities. The most notable criterion of difference is in the copiousness and precision of oral speech, and connected with that, both as to origin and structure, is the unequal survival of gesture signs, which it is believed once universally prevailed. Where sign language survives it is, therefore, an instructive vestige of the prehistoric epoch, and its study may solve problems in philology and psychology. That study is best pursued by comparing the pre-eminent gesture system of the North American Indians with the more degenerate or less developed systems of other people.

EXAMINATION OF THE INDIAN SYSTEM.

The conditions and circumstances attending the prevalence, and sometimes the disuse, of sign language in North America were explained. The report of travelers that among Indians, as well as other tribes of men, some were unable to converse in the dark, because they could

not gesture, is false. It is the old story of *Βάρβαρος* and *ἀγλασσοῦς* applied by the Greeks to all who did not speak Greek, repeated by Isaiah of the "stammering" Assyrians, and now appearing in the term *slav* (speaker arrogated to themselves by a large division of the Aryan family), as contradistinguished by the Russians from the Germans, whom they stigmatize as *Njemez* (speechless.)

The theory that sign language was the original utterance of mankind does not depend upon such tales or prejudices. After the immeasurable period during which man has been upon the earth it is not probable that any existing peoples can be found among whom speech has not obviated the absolute necessity for gesture in communication between themselves.

The assertions made that the sign language of Indians originated from one definite tribe or region supposes its comparatively recent origin, whereas the conditions favorable to its development existed very long ago and were co-extensive with the territory of North America occupied by any of the tribes. Numerous evidences were presented as to its antiquity and generality. But the signs are not now, and from the nature of their formation never were, identical and uniform. The process is the same as among uninstructed deaf mutes when associated together, which was explained.

A comparison sometimes made of the diversities of the sign language of the Indians with the dialects and provincialisms of the English language is incorrect, as there is so small a proportion of the sign-using tribes which make identically the same signs to express the same ideas, and also because the signs are not absolute and arbitrary as are the words of English.

ARE SIGNS CONVENTIONAL OR INSTINCTIVE?

Sign language, as a product of evolution, has been developed rather than invented, but each of the separate signs had a definite origin arising out of some appropriate occasion, and the same sign may thus have had many different origins due to identity in the circumstances. No signs in common use were at first conventional. What may appear to be convention largely consists in the differing forms of abbreviation which have been adopted. Yet, while all Indians, as well as all gesturing men, have many signs in common, they use many others which have become conventional in the sense that their etymology and conception are not now known or regarded by those using them. The conventions by which such signs were established occurred during the long periods and under many differing circumstances. Our Indians, far from being a homogeneous race and possessing uniformity in their language, religions and customs, differ from each other more than do the several nations of Europe, and their semiotic conceptions have correspondingly differed.

PERMANENCE OF SIGNS.

Instances were presented of the ascertained permanence of some Indian signs, and of those of foreign peoples and deaf mutes. Though they, as well as words, animals and plants, have had their growth, development and change, those which are general among Indian tribes, and are also found in other parts of the world, must be of great antiquity. Many signs but little differentiated were unstable, while others that have proved to be the best modes of expression have survived as definite and established.

IS THE INDIAN SYSTEM SPECIAL AND PECULIAR?

The Indian system as a whole was compared with those of foreign peoples—the ancient Greeks and Romans, the modern Italians, the Turks, Armenians and Koords, the Bushmen of Africa, the Redjungs and Lelongs of Sumatra, the Fijians, the Chinese, Japanese, and the Australians. The result is that the so-called sign language of Indians is not, properly speaking, one language, but that it and the gesture systems of deaf-mutes and of all

peoples constitute together one language, the gesture language of mankind, of which each system is a dialect. The generic conformity is obvious, while the occasion of specific varieties can be readily understood.

ARCHÆOLOGIC RELATIONS.

The most interesting light in which Indians, as other lower tribes of men, are to be regarded, is in their present representation of the stage of evolution once passed through by our ancestors. Their signs, as well as their myths and customs, form a part of the paleontology of humanity. Their picture writings are now translated by working on the hypothesis that their rude form of graphic representation, when at the same time a system of ideographic gesture signs prevailed, would probably have been connected with the latter. Traces of the signs now used by the Indians are also found in the ideographic pictures of the Egyptian, Chinese and Aztec characters.

HISTORY OF THE GESTURE LANGUAGE.

From the records of the ancient classic authors, and also from the figures on Etruscan vases and Herculanean bronzes and other forms of Archaic art, it is certain that a system of gesture language is of great antiquity. Later, Quintilian gave elaborate rules for gesture, which are specially noticeable for the significant disposition of the fingers still prevailing in Naples. The ancient and modern pantomimes were discussed, and also the gestures of speaking actors in the theatres, the latter being seldom actually significant or self-interpreting even, in the expression of strong emotion. The same scenic gesture must apply to many diverse conditions of fact. Its fitness consists in being the same which the hearer of the expository words would spontaneously assume, if yielding to the same emotions, and which, therefore, by association, tends to induce sympathetic yielding. But the communication of the facts themselves depends upon the words uttered. A true sign language would express the exact circumstances, with or without any exhibition of the general emotion appropriate to them.

PRACTICAL APPLICATION OF SIGN LANGUAGE.

This was shown to be in successful use in cases cited by travelers skilled in it, and its powers were compared with those of speech. It finds actually in nature an image by which any person can express his thoughts and wishes on the most needful subjects to any other person. Merely emotional sounds may correspond with merely emotional gestures, but whether with or without them would be useless for the explicit communication of facts and opinions of which signs themselves are capable. Notwithstanding frequent denials, they are able to express abstract ideas. The rapidity of their communication is very great, and can approach to that of thought. Oral speech is now conventional, and with the similar development of sign language, conventional expressions could be made with hands and body more quickly than with the vocal organs, because more organs could be worked at once.

But such rapidity is only obtained by a system of preconcerted abbreviations and by the adoption of absolute forms, thus sacrificing self-interpretation and naturalness, as has been the case with all oral languages in the degree of their copiousness and precision.

RELATIONS IN PHILOLOGY.

Signs often gave to spoken words their first significance, and many primordial roots of language are found in bodily actions. Examples are given of English, Indian, Greek and Latin words in connection with gesture signs for the same meaning, and the structure of the sign-language was compared with the tongues of this continent, with reference also to old Asiatic and African

languages, showing similar operations of conditions in the same psychologic horizon.

ORIGIN OF SPEECH.

It is necessary to be free from the vague popular impression that some oral language of the general character of that now used by man is "natural" to man. There is no more necessary connection between ideas and sounds, the mere signs of words that strike the ear, than there is between the same ideas and signs for them which are addressed only to the eye. Early concepts of thought were of a direct and material character. This is shown by what has been ascertained of the radicals of language, and there does not seem to be any difficulty in expressing by gesture all that could have been expressed by those radicals.

CONCLUSIONS.

It may be conceded that after man had all his present faculties, he did not choose between the adoption of voice and gesture, and never with those faculties, was in a state where the one was used, to the absolute exclusion of the other. The epoch, however, to which our speculations relate is that in which he had not reached the present symmetric development of his intellect and of his bodily organs, and the inquiry is: Which mode of communication was earliest adopted to his single wants and informed intelligence? With the voice he could imitate distinctively but few sounds of nature, while with gesture he could exhibit actions, motions, positions, forms, dimensions, directions and distances, with their derivations and analogues. It would seem from this unequal division of capacity that oral speech remained rudimentary long after gesture had become an efficient mode of communication. With due allowance for all purely imitative sounds, and for the spontaneous action of vocal organs under excitement, it appears that the connection between ideas and words is only to be explained by a compact between speaker and hearer which supposes the existence of a prior mode of communication. This was probably by gesture. At least we may accept it as a clew leading out of the labyrinth of philological confusion, and regulating the immemorial quest of man's primitive speech.

TRICHINÆ CYSTS.

The mode of formation of the cyst of trichina has been studied by M. Chatin and described in a communication to the Académie de Sciences. It was formerly said to be formed partly from the contractile tissue, and partly by a secretion from the nematoid, but this opinion was based only on some apparent differences in the thickness or aspect of the cyst wall, and not on any careful study of its formation, which necessitates the examination of animals dying or killed in different states of the affection. When it arrives in the muscles the worm forms adhesions with the interfascicular tissue in which rapid changes occur. The elements increase in size, and during the growth of the protoplasm it assumes the appearance of an amorphous mass, in which, however, nuclei and vacuoles can be seen, which seem to indicate that the mass consists really of aggregated cells. By the growth of this the primitive fibres are compressed. In the new protoplasm fine proteoid granulations are first observed, and then other granulations which present all the reactions of glycogen. Then follow important changes in the periphery of the granular mass, containing the trichina, now curled up in the interior; the outer surface becomes distinctly thickened and indurated, and may then become lamellated or present granulations or folds. The sarcolemma takes no part in the formation of the cyst except occasionally furnishing it with a purely adventitious layer. Moreover, when the nematoid contracts its first adhesions to sarcolemma, and not to the interfascicular tissue, it rapidly dies without determining a new formation.